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N<sup>o</sup>. XIII.

*Accurate determination of the right ascension and declination of  $\beta$  Bootes, and the Pole Star : in a Letter from MR. ANDREW ELLICOTT to MR. R. PATTERSON.*

Dear Sir,

October 17th, 1788.

Read Nov. 7th, 1788. **I** HEREWITH fend you the right ascensions and declinations of  $\beta$  Bootes, and the Pole Star. The Declination of  $\beta$  Bootes was determined by comparing its zenith distance, with the zenith distances of  $\alpha$  Lyræ, Capella,  $\alpha$  Cygni,  $\gamma$  Andromedæ,  $\beta$  Medusæ, and  $\delta$  Cygni, whose declinations have been accurately determined by the European astronomers. The zenith distances, were taken by the sector which was used on the Northern boundary of this state, and was made by our own countryman Mr. Rittenhouse, and graduated by a method of his own; to say more in its favour, would be superfluous. The right ascension was determined by comparing its passage over the meridian, with the most convenient of those contained in the 10th table, annexed to the first Volume, of the Rev. Doct. Maskelyne's astronomical observations. This star will be found very useful, in determining latitudes within the Northern, and Southern limits of the United States.

The right ascension and declination of the Pole star, I have deduced from the observations of the Rev. Doctor Maskelyne. This star is of such consequence in tracing a meridian, that it is a wonder so little attention has been paid to it by the European astronomers: it is however liable to one inconvenience, on account of the change in its annual variation in right ascension; but this may be nearly corrected for many years, by using an arithmetical progression, an example of which will be found at the end of the tables of aberration and nutation. In

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In applying the corrections contained in the tables of aberration and nutation, it is only necessary to observe this *rule*. When the Sun's place or place of the Moon's ascending node is on the left side of the first column,—use the sign on the left side of the column required, and *vice versa*.

Sun's place and place of the Moon's ascending node.	The Right Ascension and Declination of $\beta$ Bootes to the beginning of 1789.			
		S   °   '   "		
	Right Ascension,	7 13 30 3,5	} Ann. Var. {	+ 34. 1
	Declination,	41 13 47,94	}	- 14. 53
S. D. S.	Aberration in R. Ascension.	Aberration in Declination.	Nutation in R. Ascension.	Nutation in Declination.
O. VI.	"	"	"	"
o	+ 17. 70—	-14. 30 †	+ 6. 07—	-6. 57 †
10	20. 61	12. 34	3. 93	5. 57
20	22. 90	10. 17	1. 59	4. 41
I. o VII.	24. 48	7. 61	-0. 79 +	3. 10
10	25. 32	4. 81	3. 09	1. 71
20	25. 40	1. 87	5. 30	0. 26
II. o VIII.	24. 70	+ 1. 13—	7. 43	+ 1. 19—
10	23. 25	4. 10	9. 39	2. 62
20	21. 09	6. 94	10. 21	3. 96
III. o IX.	18. 30	9. 57	12. 10	5. 18
10	14. 95	11. 90	12. 92	6. 24
20	11. 14	13. 88	13. 43	7. 11
IV. o X.	6. 99	15. 44	13. 51	7. 77
10	2. 61	16. 53	13. 11	8. 19
20	-1. 79 †	17. 11	12. 38	8. 36
V. o XI.	6. 18	17. 11	11. 30	8. 28
10	10. 37	16. 72	9. 83	7. 95
20	14. 30	15. 75	8. 03	7. 37
VI. o	17. 70	14. 30	6. 07	6. 57

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Sun's place and place of the Moon's ascending Node.		The Right Ascension and Declination of the Pole Star to the beginning of the year 1789.			
		S ° ' "		} Ann. Var. {	
		Right Ascension, ° 12 32 7,06		} + 183,03*	
		Declination, 88 10 40,8		} + 19,4	
S. D. S.	Aberration in R. Ascension.	Aberration in Declination.	Nutation in R. Ascension.	Nutation in Declination.	
O. VI.	' "	"	' "	"	
0	-9. 19+	+3. 72-	-4 49+	+ 2. 11-	
10	9. 34	0. 27	5 00	0. 86	
20	9. 32	-3. 18+	4. 54	-0. 41+	
I. VII.	9. 12	6. 54	4. 43	1. 67	
10	8. 35	9. 69	4. 23	2. 86	
20	7. 43	12. 56	3. 55	3. 98	
II. VIII.	6. 35	15. 04	3. 20	4. 98	
10	5. 18	17. 07	2. 39	5. 82	
20	3. 50	18. 57	1. 55	6. 49	
III. IX.	2. 15	19. 51	1. 4	6. 96	
10	0. 36	19. 86	0. 13	7. 22	
20	+1. 40-	19. 61	+ 0. 39--	7. 26	
IV. X.	2. 42	18. 75	1. 29	7. 08	
10	4. 16	17. 30	2. 17	6. 69	
20	5. 41	15. 39	3. 1	6. 09	
V. XI.	6. 57	12. 97	3. 39	5. 31	
10	7. 59	10. 16	4. 9	4. 36	
20	8. 47	7. 05	4. 34	3. 28	
VI. O.	9. 19	3. 72	4. 49	2. 11	

\* The right Ascension of this Star (independent of the Ann. Var.) must be increased by an arithmetical progression, the first term and common difference of which is 1".01, and the number of terms will be the years elapsed since 1789:—as for example, let it be required to find the Right Ascension of the Pole Star, on the 1st of January 1800. Then 1".01 X 11 = 11".11 the last term, and 11".11 + 1".01 = 12".12 = the sum of the extremes;—then  $\frac{12".12}{2} \times 11 = 66".66$  which is the sum of the progression,—then the Annual Variation 183".03 X 11 = 2013".83 = 3333". this added to 08. 12° 32' 7". 06. will give 08. 13° 5' 40". 39, and this sum increased by the sum of the progression 1' 6". 66 will give 08. 13° 6' 47". 05, for the mean Right Ascension of the Star: but if the Right Ascension of the Pole Star is required before the beginning of the year 1689, then the Ann. Var. and sum of the progression will be deductive.

*Account*